

What is claimed is:

1. A process for preparing butadiene from n-butane having the steps of
 - A) providing a feed gas stream a comprising n-butane;
 - B) feeding the feed gas stream a comprising n-butane into at least one first dehydrogenation zone and nonoxidatively catalytically dehydrogenating n-butane to obtain a product gas stream b comprising n-butane, 1-butene, 2-butene, butadiene, hydrogen, low-boiling secondary constituents and in some cases steam;
 - C) feeding the product gas stream b of the nonoxidative catalytic dehydrogenation and an oxygenous gas into at least one second dehydrogenation zone and oxidatively dehydrogenating 1-butene and 2-butene to obtain a product gas stream c comprising n-butane, 2-butene, butadiene, hydrogen, low-boiling secondary constituents and steam, said product gas stream c having a higher content of butadiene than the product gas stream b;
 - D) removing hydrogen, the low-boiling secondary constituents and steam to obtain a C₄ product gas stream d substantially consisting of n-butane, 2-butene and butadiene;
 - E) feeding the C₄ product gas stream d into a distillation zone and removing a butadiene/butane mixture as the product of value stream e1, to leave a stream e2 consisting substantially of n-butane and 2-butene;
 - F) recycling the stream e2 into the first dehydrogenation zone.
2. The process according to claim 1, wherein the nonoxidative catalytic hydrogenation of n-butane is carried out autothermally.
3. The process according to claim 1 or 2, wherein the feed gas stream containing n-butane is obtained from liquefied petroleum gas (LPG).